Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Modernizing and Expanding Access to the 70/80/90 GHz Bands	)	WT Docket No. 20-133
	)	
Amendment of Part 101 of the Commission's Rules to Facilitate the Use of Microwave for Wireless Backhaul and Other Uses and to Provide Additional Flexibility to Broadcast Auxiliary Service and Operational Fixed Microwave Licensees	)	WT Docket No. 10-153
	)	
Aeronet Global Communications Inc. Petitions for Rulemaking to Amend the Commission's Allocation and Service Rules for the 71-76 GHz, 81-86 GHz, and 92-95 GHz Bands to Authorize Aviation and Maritime Scheduled Dynamic Datalinks	)	RM-11824 (Aviation) RM-11825 (Maritime)
	)	
Requests of Aviat Networks and CBF Networks, Inc. d/b/a Fastback Networks for Waiver of Certain Antenna Requirements in the 71-76 and 81-86 GHz Bands	)	WT Docket No. 15-244 (Terminated)

COMMENTS OF LOON LLC

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Loon LLC ("Loon") is pleased to submit comments in the above-captioned proceedings as they pertain to the 71-76 GHz and 81-86 GHz bands (hereinafter the 70/80 GHz bands).[1] We

[1] *See Modernizing and Expanding Access to the 70/80/90 GHz Bands, et al.*, WT Docket No. 20-133, et al., Notice of Proposed Rulemaking and Order, FCC 20-76 (rel. June 10, 2020) (NPRM). *See also* Aeronet Global Communications Inc.'s Petition for Rulemaking to Amend the Commission's Allocation and Service Rules for the 71-76 GHz, 81-86 GHz, and 92-95 GHz Bands to Authorize Aviation Scheduled Dynamic Datalinks, RM-11824, Public Notice, dated February 7, 2019 ("Aviation Petition"); Aeronet Global Communications Inc.'s Petition for

applaud the Commission for continuing to drive innovative uses of spectrum for the benefit of all consumers. The Commission has been a pioneer and continues its strong leadership in the development of flexible rules for spectrum management. In establishing its light-licensing framework for the 70/80 GHz bands in 2003, the Commission furthered its goals to expand access to broadband and foster the efficient use of this spectrum in the public interest.[2] This flexible and streamlined regulatory framework has fostered tremendous interest in the bands for innovative connectivity use cases, including the 5G, maritime, aircraft, stratospheric, and satellite use cases that are the subject of this proceeding.[3]

Loon appreciates the importance of robust in-flight and maritime connectivity. In light of the ongoing pandemic, economic crisis, and the predicted above-normal Atlantic hurricane season, however, the Commission should ensure that this proceeding incorporates the widest possible set of use cases into its existing framework, including those focused on closing the digital divide and enabling disaster preparedness. By adopting flexible, technology-neutral rules and setting a path toward dynamic coordination for all services in the bands, the Commission can ensure simultaneous technological innovation on land, at sea, in the sky, and in space.

I. INTRODUCTION AND SUMMARY

Loon, a subsidiary of Alphabet Inc., is bringing balloon-powered Internet access to unserved and underserved communities around the world. Loon's unmanned, high-altitude

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Rulemaking to Amend the Commission's Allocation and Service Rules for the 71-76 GHz, 81-86 GHz, and 92-95 GHz Bands to Authorize Maritime Scheduled Dynamic Datalinks, RM-11825, Public Notice, dated February 7, 2019 ("Maritime Petition") (collectively, "the Petitions").

[2] NPRM ¶ 8.

[3] *Allocations and Service Rules for 71–76 GHz, 81–86 GHz and 92–95 GHz Bands*, WT Docket No. 02-146, Report and Order, 18 FCC Rcd 23318 ¶ 1 (2003) (2003 Order).

balloons are capable of months-long flights at altitudes of approximately 20 kilometers. To date, Loon balloons have travelled more than 40 million kilometers and one million hours in the stratosphere. They are equipped with energy-efficient communications equipment that uses standard LTE frequencies for the user access links, and the 70/80 GHz bands for backhaul/feeder links. Each Loon balloon can provide service using standard LTE frequencies directly to standard LTE handsets over an area of 13,000 square kilometers.

In the time since Loon filed its comments on Aeronet's petitions to unlock the "Internet of the Sky" and the "Internet of the Sea,"[4] Loon has demonstrated myriad consumer and public interest benefits using the 70/80 GHz bands, and continues to expand not only our technical capabilities, but also our relationships with mobile network operators (MNOs). As of 2020, Loon's stratospheric Internet platform has connected 300,000 end users in disaster and emergency response scenarios in Peru and Puerto Rico.[5] In May 2020, Loon announced a global partnership with AT&T to extend our disaster preparedness services to any of AT&T's roaming partners around the world, enabling rapid response to natural disasters in situations where terrestrial infrastructure has been damaged or destroyed.[6] In July 2020, Loon officially launched its service with Telkom Kenya to an initial service region of nearly 50,000 square kilometers

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[4] *See Aeronet Global Communications Inc.'s Petition for Rulemaking to Amend the Commission's Allocation and Service Rules for the 71-76 GHz, 81-86 GHz, and 92-95 GHz Bands to Authorize Aviation Scheduled Dynamic Datalinks, et al.*, RM-11824, RM-11825, Comments of Loon LLC (Mar. 11, 2019) (2019 Loon Comments on Aeronet Petitions).

[5] *See* Alastair Westgarth, "Turning on Project Loon in Puerto Rico," Loon Blog (Oct. 20, 2017), *available at* https://medium.com/loon-for-all/turning-on-project-loon-in-puerto-rico-f3aa41ad2d7f.

[6] *See* Alastair Westgarth, "Working with AT&T to offer a global connectivity solution in times of disaster," Loon Blog (May 5, 2020), *available at* https://medium.com/loon-for-all/working-with-at-t-to-offer-a-global-connectivity-solution-in-times-of-disaster-450d8cb9a448.

across western and central parts of the country, conducting successful trials that have brought mobile service to areas that lack terrestrial infrastructure.[7] Loon also has announced a partnership with Vodacom to provide service to Vodacom's end users in Mozambique.[8]

To manage its network and ensure coexistence with existing and future users of the 70/80 GHz bands, Loon has pioneered a temporospatial software-defined networking (Temporospatial SDN) platform designed specifically for the orchestration of the physical wireless link topology, radio resource management, and routing of traffic through aerospace networks, including high altitude platform stations (HAPS) and nongeostationary satellites.[9] Temporospatial SDN combines environmental data, signal propagation models, per-node radio hardware/antenna configurations, spectrum regulations, and licensing information through powerful cloud-based software to optimize the operational control of aerospace networks and to coordinate interference avoidance.[10] The system has been working in Loon's production network for more than three years, and has demonstrated the ability to create meshes spanning more than 20 balloons and

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[7] *See* Alastair Westgarth, "Loon is live in Kenya," Loon Blog (July 6, 2020), *available at* https://medium.com/loon-for-all/loon-is-live-in-kenya-259d81c75a7a.

[8] *See* Abdi Latif Dahir, "A Bird? A Plane? No, It's a Google Balloon Beaming the Internet," New York Times (July 7, 2020), *available at* https://www.nytimes.com/2020/07/07/world/africa/google-loon-balloon-kenya.html; Alastair Westgarth, "Bringing Loon to Mozambique," Loon Blog (May 12, 2020), *available at* https://medium.com/loon-for-all/bringing-loon-to-mozambique-1a0aea489b74.

[9] *See* Salvatore Candido, "The connectivity brain behind Loon's network," Loon Blog (Jan. 31, 2019), *available at* https://medium.com/loon-for-all/the-connectivity-brain-behind-loons-network-f26c2b0b4288.

[10] A description of Loon's Temporospatial SDN can be found here: https://loon.com/solutions/network-orchestration (last visited August 5, 2020). For a technical paper on Temporospatial SDN and its interference avoidance capabilities, *see* Brian Barritt and Vint Cerf, "Loon SDN: Applicability to NASA's Next-Generation Space Communications Architecture," 2018 IEEE Aerospace Conference, *available at* https://research.google/pubs/pub47138/.

4,000 km in the stratosphere and to coexist with other services (e.g., fixed service, fixed-satellite service, and radio astronomy service) without causing harmful interference.

In the context of the 70/80 GHz bands, Loon's Temporospatial SDN maintains an updated set of link registration data and other spectrum usage data to anticipate potential harmful interference scenarios and dynamically avoid them. For example, the system regularly downloads and incorporates publicly available databases related to radio astronomy installations, fixed point-to-point links, fixed spot-beam satellite TLEs, and more. Loon's Temporospatial SDN also can incorporate regulatory constraints including power limits, allowable interference limits, or exclusive operation zones around ground stations to maintain compliance with regulatory requirements. Importantly, Loon's Temporospatial SDN is flexible enough to accommodate and coordinate static and moving links on the ground, in the sky, and in space, so that as more users deploy services in the 70/80 GHz bands, Loon's Temporospatial SDN will enable such multiple services to coexist with each other. It is also scalable, and capable of coordinating millions of antennas.

As explained below, based on Loon's experience deploying stratospheric networks and designing systems to ensure coexistence of all users of the 70/80 GHz bands, we support the Commission's proposal to authorize antennas in motion in the 70/80 GHz bands and to incorporate services that rely on them into its existing light-licensing framework. With minor modifications to the current databases and a path toward a more dynamic self-coordination system, link registration managers will be able to accommodate a variety of existing and new users into the band while respecting the co-primary allocation that those services enjoy.

II. ANTENNAS IN MOTION

A. Loon Supports the Commission's Proposal to Authorize Antennas in Motion in the 70/80 GHz Bands

Loon supports the Commission's proposal to authorize antennas in motion in the 70/80 GHz bands.[11] Services that rely on antennas in motion will bring significant innovation, competition, and consumer benefit, whether they are connecting a passenger on a ship or aircraft or a consumer in an unserved area.[12] As explained above in Section I, Loon already has demonstrated the tremendous public interest benefits of services that can operate using antennas in motion.[13] Loon is pioneering connectivity in the stratosphere, creating a "third layer" between ground-based and satellite connectivity and unlocking a new stratospheric connectivity ecosystem. By partnering with network operators, Loon serves as a complement to existing mobile and satellite networks in a way that enhances network reach and capacity without the significant capital expenditures of traditional terrestrial and space-based deployments. Moreover, Loon is committed to meaningfully addressing critical public policy goals, including universal

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[11] *See* NPRM ¶ 22.

[12] *See* Loon, "The Stratosphere: High Altitude, Higher Ambitions," 5 (2020), *available at* https://www.loon.co/resources/content-library/.

[13] As the Commission recognizes in the NPRM, stratospheric Internet platforms such as Loon defy simple classification into traditional definitional constraints, and may be considered a fixed service (e.g., a "nominally fixed" high-altitude platform station) or a mobile service (in a manner similar to Aeronet's service), depending on the specific operation of the system. For Loon's network, this flexibility—powered by state-of-the-art stratospheric navigation and networking software—is a feature of the system. It enables rapid response into disaster zones, flexible deployment to unserved and remote areas, and coexistence with existing and future point-to-point services. In this proceeding, the Commission should authorize operation of both nominally fixed and moving stratospheric Internet platforms so long as they comply with the applicable technical and operational rules and can be reflected in the modified link registration database.

service in rural and remote areas and disaster preparedness. These benefits strongly support the Commission's proposal to authorize antennas in motion in the 70/80 GHz bands.

The Commission's authorization of antennas in motion will not significantly impact existing point-to-point microwave services or the deployment of future non-Federal and Federal services in the bands.[14] As the Commission recognized in its 2003 Order, due to the high-gain, directional nature of "pencil beam" point-to-point systems within the 70/80 GHz bands, they "may be engineered to operate in close proximity to other systems so that many operations can co-exist in the same vicinity without causing interference to one another," particularly in "less-densely populated rural and suburban areas, where there is an even lower chance of interference."[15] This analysis applies equally to antennas in motion. The Aeronet-commissioned Comsearch report found that "[l]ocating new [fixed service] links inside the coordination zone [around a ground station] would not involve a concern for interference except in cases of direct antenna alignment in azimuth and elevation," which would be "rare" for services operating at elevation angles at or above five degrees.[16] As such, for services such as Loon that typically operate at or above five degree elevation angles from ground stations located well outside of urban areas, the risk of interference is low. Further, even where there is proximity and antenna alignment, frequency planning and appropriately limited azimuth and elevation operations will

[14] NPRM ¶ 28.
[15] 2003 Order ¶ 45.
[16] *See* Comsearch, Aeronet Aviation and Maritime Communications Systems; Compatibility with Incumbent E-band Fixed Services and Link Registration System, 22 (May 2, 2019) (Comsearch Report), attached to Letter from Samuel L. Feder, Counsel to Aeronet Global Communications Inc. to Marlene H. Dortch, Secretary, FCC, RM-11824 and RM-11825 (filed May 10, 2019), *available at* https://ecfsapi.fcc.gov/file/110112115730/FCC%20Ex%20Parte%20-%20Aeronet%20-%20RM%2011824_RM-11825%20(2).pdf.

promote coexistence and enhance coordination between ground-based and aerospace networks.[17] Indeed, the Comsearch report noted that the use of automatic transmitter power control alone can almost entirely eliminate the risk of harmful interference.[18] Accordingly, traditional spectrum planning and frequency management techniques generally are sufficient to prevent interference between antennas in motion and existing users of the band.

As a greater number of new users seek to deploy services in the 70/80 GHz bands, link transparency and automated spectrum management tools can further enhance coexistence while respecting the co-primary allocations in the bands, including the fixed service and the fixed-satellite service.[19] As explained in Section I above, Loon has developed a software-defined

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[17] *See id.* at 22-23. While the use of elevation angles at or above five degrees is generally sufficient to prevent interference with ground-based links, the Commission should not foreclose opportunistic use of the band by aircraft at elevation angles less than five degrees where there is no meaningful risk of harmful interference (either because there are no proximate links or because the operator's software can programmatically avoid interference with existing links). For example, Temporospatial SDN can restrict Loon's operations to certain azimuth angles that would otherwise align with existing fixed service links.

[18] *See id.* at 21.

[19] Given that the Commission seeks comment to explore innovative new uses for the 70/80 GHz bands, the coordination processes for antennas in motion should seek to ensure coexistence with other co-primary users of the band and should not "prohibit[]" or "prioritiz[e]" some services in the bands at the expense of others. *See* NPRM ¶ 28. To do so could pose a risk to the fundamental principles of technology neutrality, free-market competition, and the efficient use of spectrum resources. As Chairman Pai noted in his remarks to the 2018 Global Symposium for Regulators:

> "When dealing with new technologies, I believe that one of the foundational principles for government should be regulatory humility. History tells us that emerging technologies will evolve in ways that people don't anticipate. This makes it foolish and counterproductive for government to micromanage—or more accurately, try to micromanage—their future. There is often a strong temptation to regulate new technologies, especially by forcing them into old frameworks. But my strong belief is that government should resist pre-emptive regulation when there is no market failure or consumer harm. One should not broadly regulate based solely on anticipation."

networking platform—Temporospatial SDN—to manage coexistence between static links and moving links (whether maritime, aircraft, or satellite). In building and deploying the system in markets throughout the world, Loon has gained an appreciation for the value of accurate and timely data about spectrum usage within the 70/80 GHz band. As explained in more detail in Section II.B below, Loon supports the modernization of the Commission's link registration framework and encourages the Commission to establish a pathway toward a more dynamic, self-coordinated approach that would efficiently accommodate proposed and future services in the bands.

The Commission also (1) proposes to classify links to endpoints in motion as a mobile service, (2) tentatively proposes to classify Aeronet's aircraft-based service as an aeronautical mobile service, and (3) seeks comment on rule changes necessary to accommodate other potential users of the 70/80 GHz band.[20] With the caveats below, Loon does not oppose the Commission's proposed classification of antennas in motion as a mobile service, and does not take a position on whether Aeronet's aircraft-based service is an aeronautical mobile service.

First, to the extent that the Commission classifies moving point-to-point links between a ground station and an aircraft (or between aircrafts) as an aeronautical mobile service, it should ensure that the classification accommodates all current and future aircraft, and is not limited to commercial air travel, airplanes, or aircrafts operating in controlled airspace.[21] Loon respectfully

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Remarks of FCC Chairman Ajit Pai at The 18th Global Symposium for Regulators, Geneva, Switzerland (July 10, 2018). This is particularly true for services such as Loon that are working to close the digital divide and ensure broadband connectivity for unserved areas.

[20] *See* NPRM ¶¶ 30-32, 51

[21] By classifying antennas in motion as a mobile service (whether an aeronautical mobile service or maritime mobile service), Loon sees no reason for the Commission to define a new category of "scheduled dynamic data links." Moreover, the Commission should not require links within the mobile service to follow deterministic paths, provided the service can operate so as not to

recommends that adopting the statutory definition of "aircraft" in the Federal Aviation Administration regulations would best cohere with the plain text of the "aeronautical mobile service" definition.[22]

Second, for purposes of this proceeding and modifications to the link registration database, to the extent that the Commission determines point-to-point links between antennas in motion are a mobile service, the rules should accommodate all antennas in motion, including in the stratosphere.[23] This "provider- and technology-neutral" approach to antennas in motion would enable the Commission to future-proof the 70/80 GHz bands as new and emerging services are deployed.

Finally, because mobile services—including aeronautical mobile services—enjoy a co-primary allocation in the 70/80 GHz bands, the Commission should harmonize the technical and operational rules across all static and moving point-to-point links in the 70/80 GHz bands, and also ensure that any link prioritization is radiocommunications service agnostic (e.g., first-in-time), so as not to impose *de facto* prioritization for some services over others.

B. Loon Supports the Commission's Proposal to Expand Its Light-Licensing Framework to Incorporate Antennas in Motion and to Modernize Third-Party Database Management to Accommodate Antennas in Motion

As an initial matter, Loon agrees with the Commission's proposal to "continue licensing use of 70/80 GHz bands on a non-exclusive, nationwide basis," which we agree would "facilitate

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cause harmful interference with links that have first-in-time or Federal priority. As Loon stated in its comments on Aeronet's initial petition and reiterates herein, we oppose any rule modifications that could favor Aeronet's (or any other user's) use of the 70/80 GHz bands or restrict operation by other users. *See* 2019 Loon Comments on Aeronet Petitions at 3. Technology neutrality must be the North Star of this proceeding.

[22] *See* 14 CFR § 1.1; *see also* ICAO Annex 1, Annex 6 Part I.

[23] *See* NPRM ¶ 34; *see also* 2019 Loon Comments on Aeronet Petitions at 4.

multiple types of uses in these bands, provided that an appropriate Federal coordination and non-Federal registration framework is in place."[24] The Commission's pioneering light-licensing framework has been a success in the U.S. and around the world, enabling flexible use of the band and spurring dynamic, database-driven licensing frameworks in the 70/80 GHz bands and beyond.[25] Loon applauds the Commission's forward-thinking approach in this NPRM and appreciates its commitment to technology neutrality, which is particularly important for a spectrum band with tremendous potential for a wide array of emerging connectivity solutions. To that end, the Commission should incorporate all fixed and mobile point-to-point links in its light-licensing framework for the 70/80 GHz bands, which will unleash significant innovation while ensuring coexistence and respecting the co-primary allocations that those services hold.

The Commission also seeks comment on how it might modify its link registration system to accommodate antennas in motion. Specifically, the Commission asks how links might be registered and coordinated through "multi-dimensional areas or polyhedrons" and asks how this approach might facilitate "coordination and registration [of] multiple air-based or ship-based systems."[26] Loon submits that registration of multi-dimensional areas and polyhedrons through neutral third-party database managers is a reasonable near-term solution to integrating antennas in motion into the 70/80 GHz bands, including aircraft, maritime, and other use cases. As the Comsearch study reveals, different systems of antennas in motion can reasonably coexist with

[24] NPRM ¶ 35.
[25] David Abecassis, Janette Stewart, and Alex Reichl, "Review of Spectrum Management Approaches for E-Band (70/80GHz) in Selected Markets," Analysys Mason (Jan. 5, 2016) (noting that the FCC was "the first regulator to implement a self-coordinated, light licensed regime in E-Band," which has "led the way for other regulators worldwide to adopt similar approaches," including India, New Zealand, Nigeria, Sweden, and the United Kingdom).
[26] NPRM ¶¶ 37-38.

minimal risk of interference to other static and moving links, provided there is sufficient physical distance between links, no boresight coupling, and adequate frequency planning.[27] Similar to Aeronet's proposed widebeam registration approach, systems such as Loon could register multidimensional areas (e.g., an inverted cone around a ground station) in a link registration database and then leverage Temporospatial SDN technologies to limit transmissions to that pre-registered area, ensuring no harmful interference with existing links.[28] Importantly, if the Commission adopts a multi-dimensional area or polyhedron approach, it should ensure that third-party database managers implement processes to prevent monopolization of the band by licensees, whether they are terrestrial, aircraft, maritime, or satellite users.

While registration of multi-dimensional areas and polyhedrons will enable rapid deployment of innovative solutions, we submit that in the longer term a more dynamic, real-time system would enable even greater efficiency and innovation in the 70/80 GHz bands. For that reason, the Commission should use this opportunity to set a path toward a "more robust coordination and registration mechanism"[29] that first incorporates temporospatial elements into the existing system to permit better monitoring of spectrum usage and more efficient coexistence of static and moving links, and in time evolves into a fully dynamic system that enables real-time self-coordination. This dynamic system should serve as a neutral clearinghouse for all non-Federal links in the 70/80 GHz bands, including but not limited to fixed, mobile, and fixed-satellite service links. Moreover, the dynamic system should have the ability to accept and

[27] Comsearch Report at 22-23.
[28] For this reason, the Commission need not limit its authorization of antennas in motion to systems with predetermined flight paths, provided the service can stay within a reasonable registration area.
[29] NPRM ¶ 37.

publish real-time or forecasted data on moving links (e.g., beam-pointing information) with controls to promote accurate beamwidth information. The system also should include an application programming interface (API) to enable other systems of antennas in motion to incorporate that data into their operations to avoid harmful interference through self-coordination. Finally, the system should facilitate automated coordination with and avoidance of Federal links in the bands and adjacent bands.

Setting a path toward a dynamic spectrum management system for the 70/80 GHz bands—while not a prerequisite to accommodating antennas in motion in the bands—would address a number of essential questions the Commission raises in the NPRM. For example, it would facilitate "the capability of accepting coordination data for air- and sea-based links/links between antennas in motion as a condition precedent to deployment,"[30] permit coordination and registration of multiple systems using antennas in motion (including ground-based, stratospheric, and nongeostationary satellite networks),[31] enable "track[ing] and evaluat[ing] the construction and use of all links in the event of interference issues,"[32] and accommodate existing ground-based users and future users of the band harmoniously. As Loon has demonstrated through its Temporospatial SDN, efficient and dynamic coexistence of ground-based, stratospheric, and satellite backhaul networks for the benefit of all is readily achievable.[33] The

[30] NPRM ¶ 39. Loon respectfully recommends that the Commission not require registration of air-to-air links between aircraft antennas in motion until such time that the link registration database can accommodate temporospatial elements and real-time coordination. Loon is willing to work with the Commission and any third-party database managers, as needed, to help with this process.
[31] *Id.* ¶ 38.
[32] *Id.* ¶ 36.
[33] Loon does not seek to serve as a third-party database manager. It offers these comments to demonstrate that the technology to dynamically and efficiently register and coordinate static and moving point-to-point links in the 70/80 GHz bands has already been developed, tested, and put

Commission should take this opportunity—as it did in 2003—to implement a long-term, technology neutral vision for spectrum management in the 70/80 GHz bands that will not only facilitate deployment in the near-term, but will enable innovation well into the future.

C. The Commission Should Include Stratospheric Services in Its Framework

The Commission asks whether changes to the 70/80 GHz rules should encompass "a broader array of new services," and "any other rule changes [are] necessary to accommodate other potential uses of the 70/80/90 GHz bands," such as Loon.[34] Loon respectfully submits—as it did in response to the Petitions—that the Commission uniformly apply all proposed rule modifications to all users of the 70/80 GHz bands, including stratospheric Internet platforms. Provided the authorizations and frameworks discussed above are applicable to all antennas in motion—including to, from, and between aircraft in the stratosphere—the Commission need not establish a separate framework to accommodate proposed new uses of the band.

First, the record reflects a low risk of harmful interference between stratospheric Internet platforms and existing terrestrial deployments. Specifically, the Comsearch report assumes aircraft operations as high as the lower stratosphere (50,000 ft) and at a minimum angle of five degrees elevation.[35] Comsearch determined that the five degree minimum elevation angle "mitigates much of their interference"[36] and that "[o]ff axis antenna discrimination in azimuth or elevation would resolve nearly all exposures," provided ground stations are a sufficient distance

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into production, with years of experience and millions of flight hours. As a result, development costs, technological feasibility, and market-readiness should not serve as a barrier to adopting dynamic management of the 70/80 GHz band. Loon is happy to work with the Commission and existing or potential third-party database managers to assist in the conceptualization and implementation of a neutral, third-party system for dynamically managing links in the bands.

[34] *Id.* ¶¶ 41, 51.

[35] *See* Comsearch Report at 22.

[36] *Id.* at 3.

from existing fixed service links.[37] While Loon operates at an altitude of approximately 20 kilometers, its stratospheric Internet platform operations generally mirror the worst-case elevation angle and antenna parameters outlined in the report. As such, the Comsearch report supports the conclusion that by adopting the interference mitigation techniques recommended for Aeronet's ground stations—including physical separation and frequency planning—stratospheric Internet platforms such as Loon can effectively avoid interference with incumbent fixed links.

Second, as demonstrated in Sections I and II.A above, using appropriate coordination and interference mitigation techniques, there is minimal risk of harmful interference between stratospheric Internet platforms and future services that may be deployed in the bands, including the fixed-satellite service. While the ITU has not studied nongeostationary satellites coexistence with other services in the 70/80 GHz bands, and has not yet committed to do so, coexistence studies in other millimeter wave bands with similar characteristics provide a close analogy. Specifically, ITU Report ITU-R F.2475-0 found in the context of the 38-39.5 GHz band that with adequate physical and angular separation distance, HAPS can safely coexist with other fixed, mobile, and satellite users of the band with minimal risk of interference.[38] Further, with a comprehensive, accessible database of fixed and moving links (including 5G backhaul and fixed-satellite service links) in the 70/80 GHz bands, stratospheric platforms such as Loon will be able to further mitigate the risk of harmful interference. As such, the deployment of stratospheric Internet platforms will not inhibit the deployment of future terrestrial 5G backhaul networks or fixed-satellite services. Rather, as a complementary "third layer" of the connectivity

[37] *Id.* at 4.
[38] ITU Report ITU-R F.2475-0, *Sharing and Compatibility Studies of High Altitude Platform Stations systems in the fixed service in the 38-39.5 GHz frequency range* (9/2019).

ecosystem, stratospheric Internet platforms will further enhance those terrestrial and satellite deployments.

Third, stratospheric services such as Loon have proven to be an important tool in the toolkit of mobile network operators seeking to expand their networks to unserved areas and to stand up networks quickly in the event of natural disasters. Loon has already demonstrated the value of its service in response to Hurricane Maria, and recently was granted a market trial license by the FCC to begin testing the use of the 70/80 GHz bands in Puerto Rico.[39] Thus, while in-flight broadband and cruise-ship connectivity are important elements of our national broadband infrastructure, given the ongoing pandemic, economic crisis, and the predicted above-normal Atlantic hurricane season, the Commission should ensure that this proceeding addresses the challenges of rural America and vulnerable populations by ensuring that any new rules for the 70/80 GHz bands are flexible enough to accommodate moving and nominally fixed stratospheric services.

III. TECHNICAL AND OPERATIONAL RULES; CHANNELIZATION

In the NPRM, the Commission proposes and seeks comment on several technical issues related to the 70/80 GHz bands.[40] Loon recommends that the Commission maintain the harmonized, light-touch approach to technical and operational rules across users of the 70/80 GHz bands to maximize innovation and diversity of users within the bands.[41]

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[39] *See* OET Experimental License, File Number: 0069-EX-CN-2020, Call Sign: WK2XVB (granted Mar. 26, 2020).
[40] NPRM ¶¶ 10-17, 42-48.
[41] *See Allocations and Service Rules for the 71–76 GHz, 81–86 GHz, and 92–95 GHz Bands*, WT Docket No. 02-146, Memorandum Opinion and Order, 20 FCC Rcd 4889, 4905 (2005) (2005 Reconsideration Order).

The Commission's review of 5G backhaul requirements demonstrates the need to create technical rules that reflect antenna standards for the 70/80 GHz bands to provide greater flexibility in deploying 5G wireless backhaul.[42] As an example, aligning antenna rules for static links and antennas in motion with established ITU and ETSI standards will enable rapid deployment and promote scalability.[43] Moreover, Loon encourages the Commission to continue to take a light-touch approach to channelization. As it determined in 2005, band segmentation is not "necessary to avoid warehousing or monopolistic behavior because the 'pencil beam' characteristic of transmissions in these bands ensures that even if a licensee registers for all 5 GHz in either the 71-76 GHz or 81-86 GHz bands, such transmission will still be limited to narrow 'pencil beams'; and thus will not generally preclude other link registrants from locating nearby."[44] Because usage of the 70/80 GHz bands remains at a nascent stage—with several new use cases on the horizon — it remains appropriate to "allow[] users the maximum flexibility in link design and the freedom to upgrade as their needs evolve."[45] If the Commission determines it needs to adopt a channel plan, we agree that the ITU channel plan—with no maximum bandwidth or directional limitations—is an appropriate solution. In either case, the Commission should not adopt rules that would impose *de facto* prioritization for some services over others.

Several proposals in the NPRM could hinder innovation and flexibility in the 70/80 GHz bands. For example, the Commission seeks comment on FWCC's recommendation that it allow +/- 45 degree polarization (also known as slant polarization) in the 70 GHz and 80 GHz bands.[46]

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[42] NPRM ¶ 9.
[43] *Id.* ¶ 10.
[44] 2005 Reconsideration Order ¶ 19.
[45] *Id.*
[46] NPRM ¶ 13.

Loon suggests that the Commission exercise caution in changing these requirements as it could reduce interference protections for some users. Moreover, the Commission should not increase the minimum bit rate to 1 bit per second per Hertz, which would undermine the ability of providers to offer lower-throughput transmissions (e.g., rural IoT, telemetry) and would increase the cost of network deployment to rural areas by foreclosing 70/80 GHz links over long distances.[47] Physical separation, frequency planning, and a self-coordinated link registration system (including dynamic self-coordination) remain the best way to manage pencil-beam links in the 70/80 GHz bands.

IV. CONCLUSION

The Commission's proposed rule modifications for the 70/80 GHz bands will result in significant consumer and public interest benefits. Loon, therefore, supports the Commission's proposals to promote innovation in the 70/80 GHz bands and urges a prompt release of a final rule.

Respectfully submitted,

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[47] *See* 2005 Reconsideration Order ¶ 20.